

Internal Parasites from the Marten (*Martes americana*) in Eastern Washington

WILLIAM J. FOREYT and JOHN E. LAGERQUIST

Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, Washington 99164-7040

ABSTRACT: Helminths were recovered from 37 of 42 (88%) American martens (*Martes americana*) collected from northeastern Washington in December of 1990. *Capillaria putorii* was detected in the stomachs of 36 (86%) martens, *Mesocostoides lineatus* in the small intestines of 14 (33%), and *Trichinella spiralis* in the tongues of 2 (5%). Prevalence of *M. lineatus* was significantly greater ($P < 0.05$) in juveniles than adults, and simultaneous infections with both helminths was significantly greater ($P < 0.05$) in juveniles than adults. Histologic examination of the tongues revealed *Sarcocystis* sp. in 4 of 42 (10%) martens. *Capillaria putorii* is reported for the first time in martens in Washington. The number of helminths from martens in northeastern Washington was fewer than reported from western Washington.

KEY WORDS: Marten, *Martes americana*, *Capillaria putorii*, *Mesocostoides lineatus*, *Trichinella spiralis*, helminths, *Sarcocystis*, Washington.

Helminths in martens (*Martes americana*) have been reported in western Washington (Hoberg et al., 1990) and other regions of North America (Holmes, 1963; Butterworth and Beverley-Burton, 1980, 1981; Poole et al., 1983; Scranton, 1986). In these previous reports from different regions of North America, helminth species diversity, prevalence, and intensity have varied greatly. We report the recovery of 3 species of helminths during necropsy examinations of 42 martens from northeastern Washington, including the first report of *Capillaria putorii* in martens in Washington, and compare the helminth recovery in this study with a recent study conducted in western Washington.

Materials and Methods

Forty-two marten carcasses (22 females, 20 males, 19 juveniles, 16 adults, 7 age undetermined) were obtained by a trapper from Pend Oreille County (48°7'30" to 49°00'N, 117°2' to 117°26'W) in northeastern Washington. The martens were trapped in December 1990, skinned, and the carcasses frozen before transport to Washington State University for examination. Carcasses were thawed at room temperature (21°C) prior to necropsy. At necropsy each animal was weighed and the sex determined. Tongues were removed and fixed in 10% buffered formalin. An approximately 1-cm³ piece of each tongue was embedded in paraffin, sectioned at 6 μ m, stained with hematoxylin and eosin, and examined microscopically at 40 \times for the presence of parasites. Heads were removed and placed in a solution of bleach and hot water to facilitate the removal of flesh from the skull. The skulls were examined to determine the age of the animals (juvenile vs. adult) as described by Taber (1971) and Strickland et al. (1982). Trachea, lungs, liver, kidneys, and the gastrointestinal tract were removed for examination. Lungs and livers

were cut into approximately 1-cm sections and viewed for parasites using a light magnifying lens. Kidneys were cut longitudinally and examined grossly. The gastrointestinal tract was divided into 3 sections: stomach, small intestine, and large intestine. Each section was cut open, the mucosa scraped and the contents preserved in separate jars of 10% formalin and examined for parasites using a dissecting microscope at 15 \times . Parasites were counted and stored in 10% formalin. A representative sample of nematodes and cestodes as mounted in CMCP-9AF mounting medium (Masters Chemical Company, Inc., 520 Bonnie Lane, Elk Grove, Illinois 60007) for identification. The cestodes were stained in Semichon's acetic carmine prior to mounting. Representative specimens have been deposited in the U.S. National Museum Parasite Collection (Beltsville, Maryland 20705) as follows: *C. putorii*, No. 82299; *Mesocostoides lineatus*, No. 82300.

One-way analysis of variance tests were used to compare helminth intensity and prevalence between age classes and sexes to identify significant differences ($P < 0.05$).

A fecal sample was collected from the large intestine of 33 martens (9 animals had no feces present in the gastrointestinal tract) and examined microscopically for the presence of parasite eggs using a sugar flotation centrifugation technique. Differences in prevalence and intensity of parasites between sexes and age classes were compared.

Results and Discussion

Helminths were recovered from 37 of 42 (88%) martens. *C. putorii* (Rudolphi, 1819) and *M. lineatus* (Goeze, 1782) were the only gastrointestinal helminths recovered (Table 1). Prevalence of *M. lineatus* and simultaneous infections with both helminths were significantly greater ($P < 0.05$) in juveniles than adults. No other significant differences were observed in prevalence or

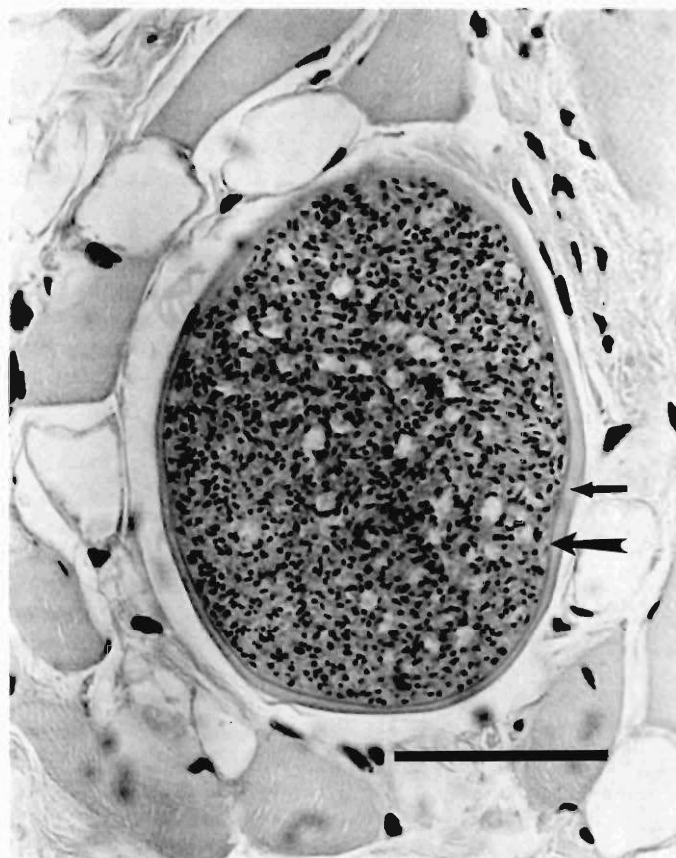


Figure 1. *Sarcocystis* sp. in the tongue of a marten. Note the thin wall (large arrow) of the nonseptate sarcocyst, and the muscle cell (small arrow). Scale bar = 20 μ m.

intensity between age classes or sexes. When present, *C. putorii* was always detected in the stomach, occasionally in the small intestine (8 martens) and rarely in the large intestine (2 martens). The mean intensity of *C. putorii* in the stomach, small intestine, and large intestine was 55.4, 4.0, and 1.5 worms, respectively. *Capillaria putorii* occurs in the stomach and intestine of the marten, ferret (*Mustela putorius furo*), mink (*Mustela vison*), short-tailed weasel (*Mustela erminea*), raccoon (*Procyon lotor*), fisher (*Martes pennanti*), and striped skunk (*Mephitis mephitis*) (Levine, 1980; Butterworth and Beverley-Burton, 1981).

The cestode *M. lineatus* was found exclusively in the small intestine. *Mesocostoides* sp. has previously been reported in martens in Washington (Hoberg et al., 1990). Among the 37 martens from which helminths were recovered, 84% had only *C. putorii*, 3% had only *M. lineatus*, and

35% were simultaneously infected with both parasites. No helminths were found in the trachea, lungs, liver, or kidneys of any of the martens.

Histologic analysis of the tongues revealed *Trichinella spiralis* (Owen, 1835) larvae in 2 martens, one containing 3 larvae and the other 2 larvae. Cysts of *Sarcocystis* sp. were found in the tongues of 4 martens. Mean size of 32 sarcocysts was $63.9 \times 49.9 \mu\text{m}$ (range, $24\text{--}132 \times 24\text{--}79 \mu\text{m}$), and the mean intensity was 15 (range, 2–30) sarcocysts per tongue. Cysts were nonseptate with thin walls (Fig. 1). To our knowledge, this is the first report of the occurrence of *Sarcocystis* sp. cysts (sarcocyst) in marten. The presence of sarcocysts in a carnivore host is atypical. Generally, sarcocyst formation occurs in an intermediate herbivorous host (asexual) and oocyst production (sexual) in a definitive carnivore host. Sarcocysts have occasionally been detected in carnivores. Kirkpatrick et al. (1986), Everitt et

Table 1. Prevalence and intensity of helminths of martens from Pend Oreille County, Washington, U.S.A.

Helminth	All hosts (<i>N</i> = 42)	Males (<i>N</i> = 20)	Females (<i>N</i> = 22)	Juveniles (<i>N</i> = 19)	Adults (<i>N</i> = 16)
<i>Capillaria putorii</i>	86 (2–477) 56*	85 (4–89) 40	86 (2–477) 72	84 (2–87) 34	94 (9–477) 73
<i>Mesocostoides lineatus</i>	33 (1–43) 10	40 (1–43) 11	27 (1–19) 10	58 (1–43) 12	19 (1–10) 5
<i>C. putorii</i> and <i>M. lineatus</i>	31 (NA)† NA	35 (NA) NA	27 (NA) NA	53 (NA) NA	19 (NA) NA
<i>C. putorii</i> or <i>M. lineatus</i>	88 (NA) NA	90 (NA) NA	86 (NA) NA	89 (NA) NA	94 (NA) NA
<i>Trichinella spiralis</i>	5 (2–3) 3	10 (2–3) 3	0 (0) 0	0 (0) 0	13 (2–3) 3

* Percent prevalence (range in intensity) mean intensity.

† Not applicable.

al. (1987), Fiori and Lowndes (1988), and Edwards et al. (1988) found *Sarcocystis* in tissues of domestic cats, and Hill et al. (1988) detected sarcocysts in the muscles of a dog in addition to 2 domestic cats. Sarcocysts have been reported in raccoons (Seneviratna et al., 1975; Kirkpatrick et al., 1987; Snyder et al., 1990) and in sylvatic felids including cougars (*Felis concolor*) and bobcats (*Felis rufus*) (Greiner et al., 1989; Anderson et al., 1992). It has been suggested that sarcocyst formation in carnivores is associated with an immunocompromised host, yet in their survey of the prevalence of sarcocysts in Florida bobcats, Anderson et al. (1992) found the infected animals to be healthy and in good physical condition.

Fecal samples from 33 martens were analyzed for the presence of parasite eggs. *Capillaria* sp. eggs were present in 64% of the samples and coccidian oocysts in 6%. No other parasites were detected.

The species richness of the helminth community of martens in this study was less than reported previously from Washington by Hoberg et al. (1990). Nine species of helminths were identified in that study of 78 martens from 2 regions of western Washington (southern Cascades and northern Cascades) both located approximately 165 km or more west and south of the present study. They reported 48% of the martens from the southern Cascades (*N* = 64) had multiple helminth infections with a maximum of 4 species per host, and 21% from the northern Cascades (*N* = 14) had multiple infections with a maximum of 3 species per host. Although fewer species of parasites were identified in our study, the percentage of martens with multiple infections (35%) is equal to that reported by Hoberg et al. (1990) with both study regions combined. The 88% prevalence of helminth infection we report is very similar to the approximately 85% identified by Hoberg et al. (1990) when all 78 martens are considered. Nematodes were un-

common, intensity levels low, and *C. putorii* was not detected in martens from the southern and northern Cascade range of Washington (Hoberg et al., 1990). We found relatively high numbers of *C. putorii* present in martens from northeastern Washington (Table 1), with 9 martens having more than 50 worms and 4 with more than 100. The intensity of *M. lineatus* was similar to the mean intensity of *Mesocostoides* sp. reported by Hoberg et al. (1990) for the northern Cascades (10), but lower than the southern Cascades (20). The 5% prevalence of *T. spiralis* we detected in tongues was much lower than the 31% and 50% Hoberg et al. (1990) reported in diaphragms of martens from the southern and northern Cascades, respectively. The large difference in prevalence of *T. spiralis* between the 2 studies may be due in part to the different tissues and techniques utilized to detect *T. spiralis* larvae.

The martens in our study were trapped in a relatively small geographic area, probably comprising a specific population. This may explain the lower number of helminth species recovered in this study relative to that previously reported by Hoberg et al. (1990), the lower prevalence of *T. spiralis* and the high number of martens infected with *C. putorii*, a species not identified in the previous report. This may suggest a difference in prey availability and/or prey selection among martens in different regions of the state, resulting in a greater or lesser exposure to infection of specific parasites. Two small mammals, a red-backed vole, *Clethrionomys gapperi*, and a red squirrel, *Tamiasciurus hudsonicus*, were identified in the stomach contents of 2 martens. Their role in the transmission of parasites was not investigated.

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